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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/763,239	01/26/2004	Takao Harada	248043US3	6689

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EXAMINER	
MCNELIS, KATHLEEN A	
ART UNIT	PAPER NUMBER
1742	

DATE MAILED: 11/22/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/763,239	HARADA ET AL.	
	Examiner	Art Unit	
	Kathleen A. McNelis	1742	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 September 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-6* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Claims Status

Claims 1-6 remain for examination wherein claim 1 is amended.

Status of Previous Rejections

The previous rejection of Claims 1 and 4-6 under 35 U.S.C. 103(a) as being unpatentable over Meissner et al. (U.S. Pat. No. 5,730,775) in view of Fuji et al. (U.S. Pat. No. 6,129,777) is maintained.

The previous rejection of Claims 1 and 4-6 under 35 U.S.C. 103(a) as being unpatentable over Hoffman et al. (U.S. Pat. No. 6,749,664) or Kamei et al. (U.S. Pat. No. 6,284,017) in view of Fuji et al. (U.S. Pat. No. 6,129,777) is withdrawn in view of applicant's remarks.

The previous rejection of claims 2 and 3 under 35 U.S.C. 103(a) as being unpatentable over Hoffman et al. (U.S. Pat. No. 6,749,664) or Kamei et al. (U.S. Pat. No. 6,284,017) in view of Fuji et al. (U.S. Pat. No. 6,129,777) as applied to claim 1 alone or in further view of Nishimura et al. (U.S. Pat. No. 6,296,479) is withdrawn in view of applicant's remarks.

The previous rejection of claims 2 and 3 under 35 U.S.C. 103(a) as being unpatentable over Meissner et al. (U.S. Pat. No. 5,730,775) in view of Fuji et al. (U.S. Pat. No. 6,129,777) as applied to claim 1 alone or in further view of Nishimura et al. (U.S. Pat. No. 6,296,479) is maintained.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 1 and 4-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Meissner et al. (U.S. Pat. No. 5,730,775) in view of Fuji et al. (U.S. Pat. No. 6,129,777) alone or further in view of Sarma et al. (U.S. Pat. No. 6,117,387).

Meissner et al. in view of Fuji et al. is applied as set forth in the 6/7/2006 office action.

Regarding the limitation that the secondary combustion air be oxygen enriched, Meissner et al. '775 discloses that additional oxygen enriched air is supplied to burn volatiles and CO evolved from the compacts (col. 6 lines 1-10), therefore it would have been obvious to one of ordinary skill in the art to use oxygen enriched air for the purpose of secondary combustion air.

Alternatively, Meissner et al. in view of Fuji et al. does not disclose that oxygen enriched air is used for secondary combustion air. Sarma et al. discloses a system for producing direct reduced iron wherein oxidizing and reducing zone burners are fired by oxy-fuel combustion enabling a reduction in the amount of fuel needed while generating sufficient CO for reduction (abstract) and heating (col. 3 lines 1-15). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use oxygen enrichment as taught by Sarma et al. in secondary combustion burners of Meissner et al. in view of Fuji et al. to enable reduction and heating with lower fuel consumption as taught by Sarma et al.

Regarding the limitation that the oxygen enrichment be greater in secondary than in primary air, Meissner et al. '775 discloses that the oxygen content in the gas is a result effective variable related to atmosphere and metallization level of the compacts (col. 6 line 49-col. 7 line 3). It would therefore be obvious to one of ordinary skill in the art to adjust the oxygen concentrations (adjusting atmosphere) to improve metallization and maintain optimum productivity as taught by Meissner et al. '775 (see M.P.E.P 2144.05, II, B).

Claims 2 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Meissner et al. (U.S. Pat. No. 5,730,775) in view of Fuji et al. (U.S. Pat. No. 6,129,777) alone or further in view of Sarma et al. (U.S. Pat. No. 6,117,387) as applied to claim 1, alone or in further view of Nishimura et al. (U.S. Pat. No. 6,296,479).

Meissner et al. in view of Fuji et al. as applied to claim 1 alone or in further view of Nishimura et al. is applied as set forth in the 6/7/2006 office action.

Alternatively, Meissner et al. in view of Fuji et al. alone or further in view of Sarma et al. is applied as discussed above regarding claim 1.

Claims 1-3 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nishimura et al. (U.S. Pat. No.5,989,019) in view of Nishimura et al. (U.S. Pat. No. 6,296,479) and Saxena et al. (U.S. Pat. No. 6,368,104).

Nishimura et al. '019 discloses a rotary hearth furnace for reduction of metal oxides mixtures with coal, wherein a plurality of air feeders (22) for secondary combustion are positioned below a plurality of primary burners (4) in the vicinity of the hearth for the purposes of burning flammable gases generated from the oxide/coal mixtures (abstract and Figs. 1 and 2). Air is used in the primary combustion burners (col. 3 lines 3-23). Gases for use in secondary combustion are air or oxygen-rich gas (col. 3 lines 1-2).

Nishimura et al. '019 does not disclose that the secondary combustion air is introduced through a burner.

Nishimura et al. '479 discloses a process for reducing metal oxides on a rotary hearth furnace (abstract) using a plurality of burners wherein in some cases burners can be replaced with supply pipes for supplying oxidizing gas for combustion or used for injection oxidizing gases only (col. 5 lines 37-48 and col. 6 line 11). Therefore the means for feeding gas for secondary

combustion in Nishimura et al. '019 (col. 2 lines 45-54) is functionally equivalent to providing the gas through as secondary burner or is an art recognized substitute as taught by Nishimura et al. '479.

Nishimura et al. '019 in view of Nishimura et al. '479 does not disclose that the oxygen concentration in the primary combustion air is controlled to be lower than the oxygen concentration in the secondary combustion air.

Saxena et al. discloses an improved rotary hearth furnace wherein oxy-fuel burners and oxygen injection is used to decrease the amount of gas to the waste handling system by eliminating some of the nitrogen in the waste gas stream (col. 2 lines 1-15). It would have been obvious to one of ordinary skill in the art to use oxygen enriched gas as taught by Saxena et al. in the secondary combustion of Nishimura et al. '019 in view of Nishimura et al. '479, since Nishimura et al. '019 discloses that the gases used in secondary combustion are air or oxygen-rich gas (col. 3 lines 1-2) and Saxena et al. teaches that using oxygen enriched gas will decrease the amount of gas to the waste handling system. Further, since Nishimura et al. '019 in view of Nishimura et al. '479 discloses using air in the primary burners, the use of oxygen enrichment in the secondary combustion gas will result in the oxygen concentration in the primary combustion air to be lower than the secondary combustion air.

With respect to claims 2 and 3, Nishimura et al. '479 discloses a method of direct reduction of metal oxide with a carbonaceous material in a rotary hearth furnace (abstract). Nishimura et al. discloses the use of air inlets to provide secondary combustion in the vicinity of the iron agglomerates on the hearth (Figs. 6, 7 and col. 7 lines 28-55). Nishimura et al. teaches that the CO concentration in volume (%) is a function of at least the distance from the hearth inner

wall as shown on Fig. 9 and shows a concentration of about 4% at the inner wall in the vicinity of the ceiling (primary) burner, and is a result effective variable depending on location in the furnace.

With respect to claim 6, Saxena et al. discloses that the primary burners have different air ratios (col. 3 lines 56-65).

Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nishimura et al. (U.S. Pat. No.5,989,019) in view of Nishimura et al. (U.S. Pat. No. 6,296,479) and Saxena et al. (U.S. Pat. No. 6,368,104) as applied to claim 1, and further in view of Fuji et al. (U.S. Pat. No. 6,129,777).

Nishimura et al. '019 in view of Nishimura et al. '479 and Saxena et al. is applied as discussed above regarding claim 1.

Nishimura et al. '019 in view of Nishimura et al. '479 and Saxena et al. does not disclose that the degree of reduction represented by the formula $(CO + H_2)/(CO + CO_2 + H_2 + H_2O)$ in the atmospheric gas is less than 0.05 as in instant claim 4, that a plurality of primary burners has an air ratio of 1.0 or less as in instant claim 5.

Fuji et al. discloses a method of reducing iron oxide with carbonaceous material on a moving hearth furnace (abstract). Fuji et al. teaches providing a supply of secondary combustion air to burn combustible gases generated from the carbonaceous material in the vicinity of the iron oxide agglomerates to decrease the amount of fuel required for heating (col. 4 lines 23- 31), which is essentially the same or similar to the secondary combustion process disclosed by Nishimura et al. '019 in view of Nishimura et al. '479 and Saxena et al. In example 3, Fuji et al. varies the oxidation ratio of the combustion gas $[(CO_2 + H_2O)/(CO + CO_2 + H_2 + H_2O)]$ from 0 to 1.0 in the latter half of the reduction process to increase the metallization ratio of the iron oxide (col. 5 lines 25-58). One of ordinary skill in the art would recognize that algebraically, the sum of the

oxidation ratio disclose by Fuji et al. plus the degree of reduction disclosed by instant claim 4 must equal 1.0, i.e.:

$$\left(\frac{CO_2 + H_2O}{CO + H_2 + CO_2 + H_2O}\right) + \left(\frac{CO + H_2}{CO + H_2 + CO_2 + H_2O}\right) = 1.0$$

Therefore, by varying the oxidation ratio from 0 to 1.0 in the later half of the reduction process, Fuji et al. also varies the degree of reduction from 1.0 to 0. It would have been obvious to one of ordinary skill in the art at the time the invention was made to adjust the oxidation ratio as taught by Fuji et al. in the reduction process of Nishimura et al. '019 in view of Nishimura et al. '479 and Saxena et al. to improve the metallization as taught by Fuji et al. and desired in Nishimura et al. '019 in view of Nishimura et al. '479 and Saxena et al.

The range of between 0 and 1.0 overlaps the claimed range of less than 0.05 (claim 4) and "has an air ratio of 1.0 or less" (claim 5). It has been well settled that where the applied prior art teaches a range of compositions or properties overlapping a claimed range, a prima facie case of obviousness exists (M.P.E.P § 2144.05). Further, Fuji et al. shows that the degree of oxidation in the combustion gas is a result effective variable, which along with the time the ratio is changed affects the metallization ratio of the iron (col. 5 lines 25-58 and Fig. 4). It would have been obvious to one of ordinary skill in the art at the time the invention was made to adjust the oxidation ratio (and therefore degree of reduction) as result-effective variables to affect the metallization ratio of the iron (see M.P.E.P 2144.05, II, B).

Response to Arguments

Applicant's arguments, see pp. 4-5, filed 9/7/06, with respect to the rejection(s) of claim(s) 1-6 under 35 U.S.C. 103(a) have been fully considered and are persuasive. Therefore, the

rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Sarma et al. (U.S. Pat. No. 6,117,387).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kathleen A. McNelis whose telephone number is 571 272 3554. The examiner can normally be reached on M-F 8:00 AM to 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy King can be reached on 571-272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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11/15/2006

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